FOREWORD

During the winter of 1934, I was a pilot in the Air Corps and found myself flying the mail across the country in an open cockpit biplane. President Franklin D. Roosevelt had annulled government contracts with private airmail carriers and given the job to the Air Corps. If patriotism and heroism were enough to get the job done, this would have been a wonderful story, but the bravery and determination of the pilots were not enough to compensate for the inadequate airplanes we were flying, and we suffered many tragic losses. Aircraft in 1934 had engines, wings, and landing gear, but that was about it. During those long, cold flights across the heartland of the nation I had plenty of time to think about improvements that could and should be made to airplanes. Unfortunately, aeronautical research and development (R&D) was a low national priority and funding was always meager. Ironically, it was the death of so many Air Corps pilots during that cold winter of 1934 that drew attention to the sad state of Army aviation and motivated our leadership to increase funding for aeronautical research and development. That proved to be a critical and very timely decision because the technologies developed in the late 1930s were soon needed for thousands of aircraft flown by Allied forces to fight and win World War II.

Several years and a world war later, I found myself in a position to truly appreciate the complex business of developing and incorporating advanced technologies into new weapon systems. In the post-World War II era, these processes became infinitely more complicated than they had been in the past. The war had stimulated aeronautical research and development in Europe, as well as in the United States. We saw amazing advances in the areas of propulsion, electronics, materials, and every other technical area. Technologies advanced to the point where we no longer were developing airplanes and rockets; we were creating complex aeronautical and aerospace weapon systems. Each system consisted of a vast array of highly complex subsystems neatly configured onto a platform that worked in perfect harmony—when the engineers got it right. The trick, of course, was getting it right. The complexity and number of component systems presented engineers and program managers with some very interesting challenges. We had come a long way since the old days—only 20 years previous—when we could fly practically anything if we had enough lift, thrust, and piano wire.

Within the Air Force, Dayton has always been synonymous with aeronautical research and development. Of course, Dayton was the home of Wilbur and Orville Wright, who made the first practical use of a wind tunnel in order to obtain reliable data for achieving the world's first heavier-than-air, controlled, and powered flight in 1903. The Wrights refined their invention sufficiently by 1905 to offer a military version of their airplane to the U.S. Signal Corps. Unfortunately, Army brass failed to comprehend the enormous potential of military aviation, although many European nations had embraced the new technology and were investing heavily in aeronautical R&D.

Although the Signal Corps finally purchased the Wright Military Flyer in 1909, they saw no role for military aircraft beyond that of observation, and the flying program was poorly supported. Finally, with America's entry into World War I, the need for an organized approach to aeronautical R&D became apparent, and the Army established McCook Field in Dayton, Ohio. McCook was the nation's first installation whose purpose was to develop state-of-the-art airplanes, engines, air armament, and associated equipment. More than this, McCook Field brought together in one location many of the nation's and the world's leading aeronautical engineers and researchers. After World War I, many of these individuals went on to positions in industry and higher education, while others remained in government service. Thus was laid the foundation of that vital partnership between government, industry, and academe that led to such outstanding advances in American aerospace power in the second half of the twentieth century.

In 1927, tiny McCook closed. The Army Air Corps had looked nationwide for a new site to house its R&D organization. Dayton was eventually chosen primarily because community leaders offered free land. Also, much of the aircraft industry at the time was either already in, or relatively near, Dayton and transportation routes were excellent. So McCook engineers, scientists, and test pilots were relocated several miles east of the city in newly constructed, state-of-the-art R&D facilities named after both Wright brothers. Wright Field's laboratories and shops quickly became world-renowned.

Unfortunately, Wright Field soon saw investment in aeronautical R&D dwindle during the Great Depression. The funding shortage did not stop the pace of R&D, but it did adversely impact the number of military airplanes that were eventually purchased. Much ingenuity and creativity went into developing advanced technologies that were tested and validated on one or two aircraft but never put into production. Even when aircraft were purchased for the active inventory, the numbers were very low. We found ourselves, in the mid-1930s, in a relatively advanced state of aeronautical development—but it existed only at Wright Field, not at airfields around the nation.

I reported to the Air Corps Engineering School at Wright Field in 1939, the year that Hitler invaded Poland, and there was growing concern that the world was heading towards another world war. That fear translated into increased funding for R&D, and the pace of development was accelerating. At the Engineering School, I got a theoretical introduction to aeronautics. More than this, I developed an understanding of the problems confronting the Air Corps' intrepid band of engineers and project officers: problems of funding, recruitment, facilities, and organization. Upon graduation, I became a test pilot and learned that Wright Field was becoming a test pilot's idea of heaven. For those of us who had flown little more than World War I-era open cockpit biplanes, Wright Field gave us our first practical acquaintance with the latest combat airplanes. I can recall days when I tested five or six new aircraft. When I served at Wright Field, it was a very exciting place. The dedicated engineers who had worked there during the lean years were energized because they finally had the money and support they needed to explore advanced technologies and build new aircraft in partnership with a revitalized aircraft industry. Funding made R&D possible, and the threat of war made it imperative.

I served in the Pacific during World War II and was keenly aware that it was Wright Field that brought U.S. forces and our Allies an amazing number of specialized aircraft. Commanders in the theater of operations sent their requirements for aircraft and modifications to Dayton, and Wright Field delivered. We saw daily combat and, of course, we thought that Wright could have delivered faster and a bit better, but then we were constantly sending Wright new and ever more complex requirements. Some requirements were conflicting; some were ambiguous; and some were simply impossible. Warfighters are very picky customers because lives are on the line every time a warplane takes off. We always want more and better airplanes. The fact is, during World War II, Wright Field did deliver—splendidly.

Wright Field excelled to such a great extent during World War II largely because it was able to rapidly escalate a precise process of R&D that was perfected by its scientists, engineers, and test personnel in the 1930s. They used tried-and-true techniques to insert known technologies into aircraft designed for a myriad of special purposes and developed new technologies and solutions to problems. Then, American industry supported the war effort by devoting all possible resources to production of wartime materiel, including thousands of warplanes.

World War II was a turning point in aeronautical development. The remarkable advances of the British in airborne radar and jet engines and of the Germans in operational jet aircraft and guided missiles jolted many in the Army Air Forces' command structure into realizing not only the importance but also the preeminence in R&D in achieving and maintaining air superiority. We in the Air Force are indeed fortunate that the commanding general of the Army Air Forces was General Hap Arnold.

General Arnold is one of those pivotal figures in the history of great nations. Realizing the importance of British and German aeronautical achievements, he took the first steps toward making R&D an integral part of postwar Air Force planning and funding. Arnold's objectives were frustrated at first by the precipitate demobilization following the war and his retirement due to ill health. However, he left behind devoted colleagues and disciples who spent the next five years working toward enlarging the role of Air Force R&D. The first step was the establishment of the Air Research and Development Command (ARDC) in 1951.

In the 1950s, at a time when it appeared that the Soviet Union was beating us in the space race, I was at ARDC's Western Development Division (WDD) charged with the job of rapidly developing numerous advanced missile systems to counter the Soviet challenge. Sending ballistic missiles into outer space was not a simple process. We achieved success because we developed new processes, cut through a lot of red tape, and approached each new challenge with creativity, determination, and courage to experiment and try out new ideas. We also had sufficient funding and, perhaps more importantly, the ears of senior leaders who were always available when we called and who trusted us to act independently.

The formation of ARDC was only a first step in protecting the role of military R&D in the Air Force. A second, more decisive step was taken in 1961 with the establishment of the Air Force Systems Command (AFSC). While ARDC gave organizational status to R&D, AFSC combined R&D with procurement and production and, most importantly, with funding authority. At the same time, the Air Force's laboratories, engineering cadres, and system program offices were fundamentally reorganized.

I was fortunate to serve as the final commander of ARDC, where I had the opportunity to bring the weapon system management approach developed at WDD to the aircraft programs at the Wright Air Development Division and other acquisition centers. I served as the first commander of AFSC, when the Air Force finally achieved the unified research and development organization that Hap Arnold had envisioned. As commander of AFSC, I had full authority to control the entire development cycle of weapon systems to include research, development, test, evaluation, procurement, and production.

For the next 30 years, Systems Command was synonymous with excellence in aerospace product acquisition. During those years, the groundwork for the Air Force as we know it today was laid. With a few notable exceptions, such as the C-130 and B-52, virtually every fighter, bomber, trainer, and transport aircraft in today's inventory was envisioned, designed, built, and deployed between the early 1960s and early 1990s. And, indeed, systems only recently or not yet fielded were on the drawing boards during those years—systems like the F/A-22, the Joint Strike Fighter, and unmanned aerial vehicles. The end of the Cold War in the late 1980s and early 1990s brought about a number of reorganizations within the Air Force. Among them was the merger of Air Force Systems Command and Air Force Logistics Command (AFLC) to form the Air Force Materiel Command (AFMC).

Today, our nation is once again at war—a war on terrorism. Our military is being called upon to fight a new kind of war, a war never before envisioned and a war that quite conceivably may never end. The weapons of this war are those developed for traditional warfare and the measures of their success and failure are quite different than those in past conflicts. One thing has not changed, however. Our warfighters are being supported strongly by the AFMC laboratories as well as the acquisition, product, logistics, and test centers within AFMC, which are carrying on a tradition begun in 1917. This is the arm of the Air Force that keeps 'em flying by evolving new technologies, developing and acquiring new weapon systems, maintaining and updating existing systems, and providing the tools for our warfighters. To a large measure our troops on the front line live and die by the products of AFMC.

This fascinating book tells the story of the warfighter from a unique perspective and one that is seldom highlighted. This is the story of those who support the fighting forces by developing and acquiring new and better weapon systems. The brave pilots and flight personnel put their lives on the line for us each time they go into combat. It was comforting to me to know, when I wore the uniform and even more so today, that the tools our troops are fighting with are the products of engineers, scientists, test pilots, administrative personnel, contract and finance experts who are the best in the business when it comes to developing new warplanes. They come to their jobs every day with as much enthusiasm and determination as a pilot scrambling in response to a threat. I salute our men and women on duty in the operational Air Force and take my hat off to the dedicated acquisition personnel who labor in relative anonymity to bring state-of-the-art weapon systems to our warfighters.

It has been a great pleasure for me to devote my career to working with the good people from the world of acquisition, and I am honored to put my name on a book that celebrates their vital role in defending our nation.

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